

MARUOKA

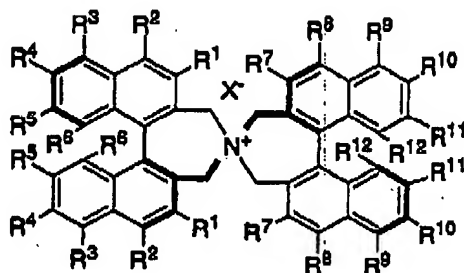
Appl. No. 10/563,658

November 26, 2008

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (original) An optically active quaternary ammonium salt, represented by the following formula (1a):



(1 a)

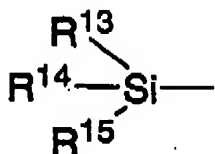
[wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^9 , R^{10} , R^{11} , and R^{12} are each independently a hydrogen atom, a methyl group, an ethyl group, a straight, branched or cyclic alkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic heteroalkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkenyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkynyl group having 3 to 18 carbon atoms, an alkoxy group having 1 to 18 carbon atoms, an aryl group having 5 to 20 carbon atoms, an aralkyl group having 5 to 35 carbon atoms, or a heteroaralkyl group having 5 to 35 carbon atoms;

with the proviso that at least one of R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^9 , R^{10} , R^{11} , and R^{12} is a substituent represented by the following formula (2a):

MARUOKA

Appl. No. 10/563,658

November 26, 2008



(2 a)

(wherein R^{13} , R^{14} , and R^{15} are each independently a methyl group, an ethyl group, a vinyl group, a straight, branched or cyclic alkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkenyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkynyl group having 3 to 18 carbon atoms, an alkoxyl group having 1 to 18 carbon atoms, an aryl group having 5 to 20 carbon atoms, an aralkyl group having 5 to 25 carbon atoms, or a heteroaralkyl group having 5 to 25 carbon atoms.);

X^- is a fluorine ion, a chloride ion, a bromide ion, an iodide ion, a p-toluenesulfonic acid ion, a hydroxide ion, a thiocyanate ion, a hydrogen sulfate ion, a perchloric acid ion, or a hexafluorophosphoric acid ion; and the two binaphthyl moieties each have a chiral axis so that the absolute configurations of the two binaphthyl moieties are (R, R) or (S, S)].

2. (original) The optically active quaternary ammonium salt according to claim 1, wherein R^1 and R^7 , R^3 and R^9 , R^4 and R^{10} , R^5 and R^{11} , and R^6 and R^{12} in the formula (1a) are in each case identical to one another; R^2 and R^8 are identical to one another and are each represented by the formula (2a); and X^- is a fluorine ion, a chloride ion, a bromide ion, an iodide ion, a p-toluenesulfonic acid ion, or a hydroxide ion.

MARUOKA

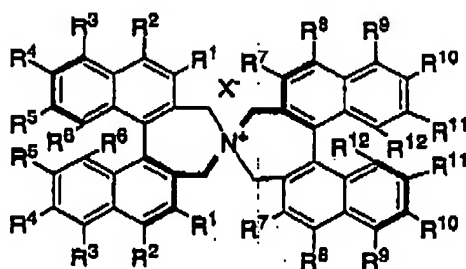
Appl. No. 10/563,658

November 26, 2008

3. (original) The optically active quaternary ammonium salt according to claim 1, wherein R^1 , R^3 , R^5 , R^6 , R^7 , R^9 , R^{11} , and R^{12} in the formula (1a) are each independently a hydrogen atom; R^2 , R^4 , R^8 , and R^{10} are identical to one another and are each represented by the formula (2a); and X^- is a chloride ion, a bromide ion, an iodide ion, or a p-toluenesulfonic acid ion.

4. (original) The optically active quaternary ammonium salt according to claim 1, wherein in the formula (1a), R^1 and R^7 , R^3 and R^9 , R^4 and R^{10} , R^5 and R^{11} , and R^6 and R^{12} are in each case identical to one another, R^2 and R^8 are identical to one another and are each represented by the formula (2a), and X^- is a bromide ion; and R^{13} , R^{14} and R^{15} in the formula (2a) are each independently a substituent selected from the group consisting of a methyl group, an ethyl group, an n-propyl group, an isopropyl group, an n-butyl group, an isobutyl group, a sec-butyl group, a tert-butyl group, an n-octyl group, and a phenyl group.

5. (original) An optically active quaternary ammonium salt represented by the following formula (1b):

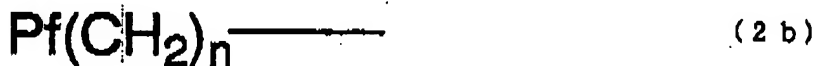


(1 b)

MARUOKA
Appl. No. 10/563,658
November 26, 2008

[wherein $R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}$, and R^{12} are each independently a hydrogen atom, a halogen atom, a methyl group that may or may not be substituted with fluorine, an ethyl group that may or may not be substituted with fluorine, a straight, branched or cyclic alkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic heteroalkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkenyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkynyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, an alkoxy group that has 1 to 18 carbon atoms and may or may not be substituted with fluorine, an aryl group that has 5 to 20 carbon atoms and may or may not be substituted with fluorine, an aralkyl group that has 5 to 35 carbon atoms and may or may not be substituted with fluorine, or a heteroaralkyl group that has 5 to 35 carbon atoms and may or may not be substituted with fluorine;

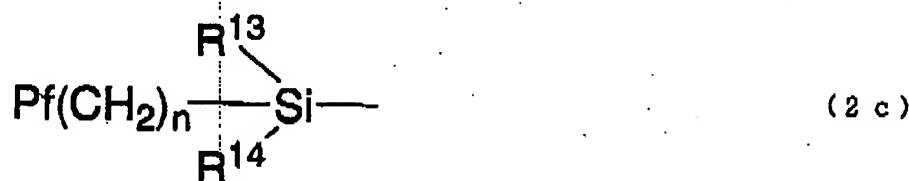
with the proviso that at least one of $R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}$, and R^{12} is a substituent represented by the following formula (2b):



(wherein Pf is a straight, branched or cyclic alkyl group that has 2 to 18 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, a straight, branched or cyclic alkenyl group that has 3 to 18 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, a straight, branched or cyclic alkynyl group that has 3 to 18 carbon atoms and has all the hydrogen

MARUOKA
 Appl. No. 10/563,658
 November 26, 2008

atoms substituted with fluorine atoms, an aryl group that has 5 to 20 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, an aralkyl group that has 5 to 25 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, or a heteroaralkyl group that has 5 to 25 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, and n is an integer from 0 to 4.), and/or by the following formula (2c):



(wherein Pf and n are as defined in the formula (2b) above, R¹³ and R¹⁴ are each independently a methyl group, an ethyl group, a vinyl group, a straight, branched or cyclic alkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkenyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkynyl group having 3 to 18 carbon atoms, an alkoxyl group having 1 to 18 carbon atoms, an aryl group having 5 to 20 carbon atoms, an aralkyl group having 5 to 25 carbon atoms, or a heteroaralkyl group having 5 to 25 carbon atoms.);

X⁻ is a fluoride ion, a chloride ion, a bromide ion, an iodide ion, a p-toluenesulfonic acid ion, a hydroxide ion, a thiocyanate ion, a hydrogen sulfate ion, a perchloric acid ion, or a hexafluorophosphoric acid ion; and the two binaphthyl moieties each have a chiral axis so that the absolute configurations of the two binaphthyl moieties are (R, R) or (S, S)].

MARUOKA

Appl. No. 10/563,658

November 26, 2008

6. (original) The optically active quaternary ammonium salt according to claim 5, wherein R^1 and R^7 , R^3 and R^9 , R^4 and R^{10} , R^5 and R^{11} , and R^6 and R^{12} in the formula (1b) are in each case identical to one another; R^2 and R^8 are identical to one another and are each represented by the formula (2a); and X^- is a fluorine ion, a chloride ion, a bromide ion, an iodide ion, a p-toluenesulfonic acid ion, a thiocyanate ion, a hydrogen sulfate ion, or a hydroxide ion.

7. (original) The optically active quaternary ammonium salt according to claim 5, wherein R^1 , R^3 , R^5 , R^6 , R^7 , R^9 , R^{11} , and R^{12} in the formula (1b) are each independently a hydrogen atom; R^2 , R^4 , R^8 , and R^{10} are identical to one another and are each represented by the formula (2c); and X^- is a chloride ion, a bromide ion, an iodide ion, or a p-toluenesulfonic acid ion.

8. (original) The optically active quaternary ammonium salt according to claim 5, wherein in the formula (1b), R^1 and R^7 , R^3 and R^9 , R^4 and R^{10} , R^5 and R^{11} , and R^6 and R^{12} are in each case identical to one another, and X^- is a bromide ion; and in the formula (2c), n is 2, R^{13} and R^{14} are each a methyl group, and Pf is an n-octyl group having all the hydrogen atoms substituted with fluorine atoms.

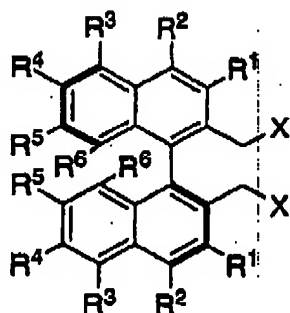
9.-14. (canceled).

MARUOKA

Appl. No. 10/563,658

November 26, 2008

15: (currently amended) A method for producing the optically active quaternary ammonium salt according to claim 1 or claim 5 represented by the formula (1a) or (1b) wherein R^1 , R^2 , R^3 , R^4 , R^5 , and R^6 are each independently a hydrogen atom, a methyl group, an ethyl group, a straight, branched or cyclic alkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic heteroalkyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkenyl group having 3 to 18 carbon atoms, a straight, branched or cyclic alkynyl group having 3 to 18 carbon atoms, an alkoxyl group having 1 to 18 carbon atoms, an aryl group having 5 to 20 carbon atoms, an aralkyl group having 5 to 35 carbon atoms, or a heteroaralkyl group having 5 to 35 carbon atoms and in which X^- is a chloride ion, a bromide ion, a iodide ion, or a p-toluenesulfonic acid ion, characterized in that the optically active binaphthyl compound represented by the formula (3a)



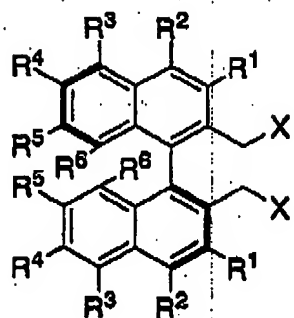
(3 a)

or (3b)

MARUOKA

Appl. No. 10/563,658

November 26, 2008

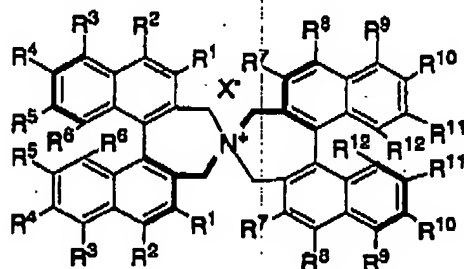


(3 b)

is reacted with ammonia.

16.-57. (canceled).

58. (currently amended) A method for recovering an optically active quaternary ammonium salt, wherein an organic solvent, water, a mixed solvent of an organic solvent and water, and/or an organic solvent with hydrogen atoms substituted with fluorine atoms are/is used to separate the optically active quaternary ammonium salt according to claim 5 represented by the formula (1b) represented by the following formula (1b):



(1 b)

MARUOKA

Appl. No. 10/563,658

November 26, 2008

[wherein R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹, and R¹² are each independently a hydrogen atom, a halogen atom, a methyl group that may or may not be substituted with fluorine, an ethyl group that may or may not be substituted with fluorine, a straight, branched or cyclic alkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic heteroalkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkenyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkynyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, an alkoxy group that has 1 to 18 carbon atoms and may or may not be substituted with fluorine, an aryl group that has 5 to 20 carbon atoms and may or may not be substituted with fluorine, an aralkyl group that has 5 to 35 carbon atoms and may or may not be substituted with fluorine, or a heteroaralkyl group that has 5 to 35 carbon atoms and may or may not be substituted with fluorine;

with the proviso that at least one of R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹, and R¹² is a substituent represented by the following formula (2b):



(wherein Pf is a straight, branched or cyclic alkyl group that has 2 to 18 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, a straight, branched or cyclic alkenyl group that has 3 to 18 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, a straight, branched or cyclic alkynyl group that has 3 to 18 carbon atoms and has all the hydrogen

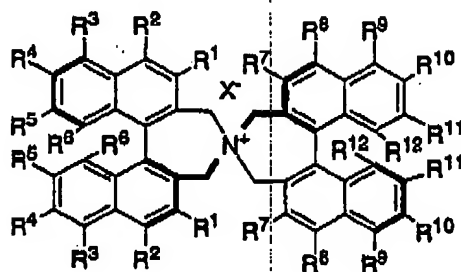
MARUOKA

Appl. No. 10/563,658

November 26, 2008

atoms substituted with fluorine atoms, an aryl group that has 5 to 20 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, an aralkyl group that has 5 to 25 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, or a heteroaralkyl group that has 5 to 25 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, and n is an integer from 0 to 4.) from a product containing the ammonium salt.

59. (currently amended) A method for recovering the optically active quaternary ammonium salt according to ~~claim 5~~ represented by the formula (1b), represented by the following formula (1b):



(1 b)

[wherein R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹, and R¹² are each independently a hydrogen atom, a halogen atom, a methyl group that may or may not be substituted with fluorine, an ethyl group that may or may not be substituted with fluorine, a straight, branched or cyclic alkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic heteroalkyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkenyl group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, a straight, branched or cyclic alkynyl

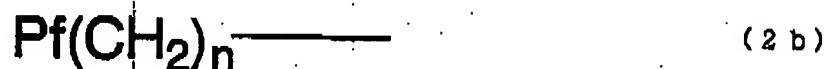
MARUOKA

Appl. No. 10/563,658

November 26, 2008

group that has 3 to 18 carbon atoms and may or may not be substituted with fluorine, an alkoxyl
group that has 1 to 18 carbon atoms and may or may not be substituted with fluorine, an aryl
group that has 5 to 20 carbon atoms and may or may not be substituted with fluorine, an aralkyl
group that has 5 to 35 carbon atoms and may or may not be substituted with fluorine, or a
heteroaralkyl group that has 5 to 35 carbon atoms and may or may not be substituted with
fluorine;

with the proviso that at least one of R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹, and R¹² is a
substituent represented by the following formula (2b):



(wherein Pf is a straight, branched or cyclic alkyl group that has 2 to 18 carbon atoms and has all
the hydrogen atoms substituted with fluorine atoms, a straight, branched or cyclic alkenyl group
that has 3 to 18 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, a
straight, branched or cyclic alkynyl group that has 3 to 18 carbon atoms and has all the hydrogen
atoms substituted with fluorine atoms, an aryl group that has 5 to 20 carbon atoms and has all the
hydrogen atoms substituted with fluorine atoms, an aralkyl group that has 5 to 25 carbon atoms
and has all the hydrogen atoms substituted with fluorine atoms, or a heteroaralkyl group that has
5 to 25 carbon atoms and has all the hydrogen atoms substituted with fluorine atoms, and n is an
integer from 0 to 4.) wherein following the production of the compound of the formula (14)

November 26, 2008

